USDA

United States
Department of
Agriculture

Forest
Service

November 2010

Environmental Assessment

Tern Lake Hazardous Fuel Reduction

Seward Ranger District, Chugach National Forest
Kenai Peninsula Borough, Alaska

TABLE OF CONTENTS

SUMMARY

The Chugach National Forest, Seward Ranger District proposes to remove dead, dying, and unhealthy trees, thin trees in specified areas, and burn and chip residual slash on approximately 412 acres. The project is located on National Forest System Land along the Seward and Sterling Highway between Tern Lake and Trail Lake. This action is needed because a spruce bark beetle (*Dendroctonus rufipennis*) infestation on the Kenai Peninsula has resulted in vast amounts of dead and dying spruce trees. The dead and dying trees have increased hazardous fuels, which increases the probability of catastrophic wildfire and the threat to communities and structures within the WUI (Wildland Urban Interface), especially near the town of Moose Pass.

In addition to the proposed action, the Forest Service also evaluated a No Action alternative.

What action is proposed?	The proposed action is to: (1) thin spruce throughout specified units and within 200' of the Seward Highway and Hannisford Road in specified units, (2) remove dead and dying spruce to reduce surface fuels, (3) and masticate/chip fuels in units adjacent to private landowners while piling and burning fuels in the remaining units.
Why?	The Tern Lake project area has been subject to a spruce bark beetle infestation. This infestation has resulted in an increase in hazardous fuels which has resulted in an elevated risk of loss of infrastructure by wildfire.
What other action would meet the same need?	None
What would it mean to not meet the need?	There would be no reduction in hazardous fuels in the Tern Lake project area. In the event of a wildfire, flame lengths would exceed four feet (90^{th} percentile weather conditions) and significantly decrease the effectiveness of fire supression efforts.
What factors would be used when making the decision between alternatives?	The environmental assessment does not identify any significant environmental consequences of the Proposed Action. However, any adverse environmental consequences of the Proposed Action are weighed against the benefit of effective fire suppression and reduction in the risk of loss of property due to wildfire.
Are there any ways to mitigate adverse effects?	The Proposed Action includes the design criteria to protect soil, streams, fish, wildlife, heritage resources, air quality and to prevent the spread of invasive plants. A complete list of all the design criteria is included in the Environmental Assessment.
What monitoring is required?	Monitoring of the thinning within 200' of the Seward Highway and Hannisford Road is required. Monitoring is required during any pile burning. Monitoring of existing population of pale poppies is required. Post-project heritage resource monitoring is required in units using mechanical treatment. Post-project monitoring of illegal recreation access within the project area.
Firewood	Firewood from thinning and fuel removal operations would be made available for both commercial and personal uses.

INTRODUCTION

Project Location

The Tern Lake project is located in the northern end of the Moose Pass area that is comprised of the communities of Moose Pass, Crown Point, Lawing, Lake-view, and Primrose. All are unincorporated communities located from 17 miles to 32 miles north of Seward, Alaska. Although separate communities, they all consider themselves to be part of the Moose Pass area.

The Moose Pass area lies in the central and eastern portion of the Kenai Peninsula, approximately 30 miles north of Seward and the southwest shore of Upper Trail Lake And at 29.3-mile of the Seward Highway. It lies at approximately 60.4875° North Latitude and -149.36889° West Longitude. (Sec. 25, T005N, R001W, Seward Meridian). Moose Pass is 100 miles south of Anchorage on the Seward Highway and 28 miles north of Seward on the Seward Highway. The project area is adjacent to state and private property.

Purpose and Need for Action

The purpose of this project is to reduce hazardous fuel and thin trees to allow effective fire suppression on National Forest System (NFS) Lands in the Moose Pass Wildland Urban Interface (WUI) of Kenai Penninsula Borough (KPB). This action is needed because a spruce bark beetle infestation on the Kenai Peninsula has resulted in vast amounts of dead and dying spruce trees in the Moose Pass area. Even with fuelwood harvesting over a large portion of the area, small diameter fuels from the dead and dying trees have increased hazardous ground fuels and resulted in an elevated risk of a wildfire causing loss of infrastructure. As spruce trees die and rot or bolewood is harvested, timber litter falls to the forest floor, increasing the fuel load. Increased fuel loads contribute to the potential for erratic, uncontrollable fire behavior. Extreme and high-hazard woody fuels are found in the Moose Pass area WUI (Kenai Peninsula Borough 2006). Spruce bark beetle mortality has impacted stand structure by killing spruce trees in the largest size classes and reducing structural diversity within the stand. Stands with a variety of vertical structure and large trees for nesting and foraging provide high quality wildlife habitat for a variety of species, including goshawks and migratory birds. Thinning trees in the project area will provide a secondary benefit of encouraging growth of the remaining trees toward larger size classes, increasing structural diversity and improving existing wildlife habitat.

Alaska's 10.25-million acre KPB is in the midst of a regional spruce bark-beetle outbreak that has resulted in extensive spruce mortality on approximately 1.06 million acres. This outbreak extends beyond the KPB, and over the last two decades an estimated 4 million acres of spruce in south-central Alaska have been infested. While spruce bark-beetle outbreaks are natural events and known to periodically occur throughout south-central Alaska, the magnitude of spruce mortality during historic episodes was typically much less (20% to 30%) than the current infestation, in which mortality rates exceed 90% in some areas.

Due to the spruce bark beetle outbreak, an interagency team developed an "All Lands/All Hands" five-year action plan (Action Plan) in 2004. In accordance with the National Fire Plan 10-Year Comprehensive Strategy, the purpose of the Action Plan has been to identify and prioritize the full range of work needed to mitigate the impacts of the spruce bark beetle on the Kenai Peninsula.

The Action Plan has played an instrumental role in identifying and prioritizing fire prevention and protection needs, hazardous fuel locations, forest health and ecosystem restoration issues, and community assistance projects on the Kenai Peninsula.

The Action Plan places a priority on working collaboratively with communities in the WUI and emphasizes the need for the communities in the Kenai Peninsula to complete Community Wildfire Protection Plans (CWPPs). These CWPPs give local community members an opportunity to consider WUI boundary locations around their community. A CWPP was developed for the Moose Pass area in 2006 by a core team of individuals within the community, including representatives from the KPB, Moose Pass Fires Department, Alaska Division of Forestry and other community members (Kenai Peninsula Burough 2006). This core team identified a need to create defensible space around homes and subdivisions in the WUI near Moose Pass by reducing ladder fuels, removing dead and dying trees, and thinning stands of trees.

National Direction

National Fire Plan

In 2000, the Secretaries of Agriculture and the Interior developed an interagency approach to respond to severe wildland fires, reduce their impacts on rural communities, and assure sufficient firefighting capacity in the future (USDA and USDI 2000). This report, known as the National Fire Plan (NFP), outlined a strategy to reduce wildland fire threats and restore forest ecosystem health in the interior West. In 2001, Congress funded the NFP to reduce hazardous fuels and restore forests and rangelands. In response, the Secretaries of Agriculture and the Interior, along with the Western Governors and other interested parties, developed a 10-year strategy and implementation plan for protecting communities and the environment (USDA and USDI 2001). This plan, coupled with the Federal Wildland Fire Management Policy (NIFC 2001), forms a framework of federal agencies, states, tribes, local governments, and communities to work together to reduce the threat of fire, improve the condition of the land, restore forest and rangeland health, and reduce wildland fire risk to communities.

Healthy Forest Initiative

Former President George W. Bush proposed the Healthy Forest Initiative (HFI) in 2002 to reduce barriers to the timely removal of hazardous fuels. The HFI proposed to expedite administrative procedures for hazardous fuel reduction and ecosystem restoration projects on federal land.

Healthy Forests Restoration Act

Sixteen months after HFI was introduced, Congress passed the Healthy Forests Restoration Act of 2003 (HFRA) (P.L. 108-148) to reduce delays and remove statutory

barriers for projects on federal land that reduce hazardous fuels and improve forest health and vigor. The act also helps rural communities, states, tribes, and landowners restore healthy forest and rangeland conditions on state, tribal, and private lands.

Criteria for projects to be authorized under this act include fuel condition class, adjacency to communities at risk, and collaboration (Federal Register, January 4, 2001, Vol. 66, No. 3, p. 751-777).

The Tern Lake Hazardous Fuel Reduction Project is authorized under HFRA to reduce hazardous fuels within the established WUI designated by the Moose Pass Area Community Wildfire Protection Plan completed March of 2006 (Kenai Peninsula Burough 2006).

HFRA requires that projects be developed in a collaborative manner. Collaboration has been ongoing throughout the planning process for the Tern Lake Hazardous Fuel Reduction Project, involving local landowners, interested parties, adjoining land management agencies, and those agencies with fire-fighting responsibilities in the project area.

Ecological Restoration and Resilience

In 2008, former Forest Service Chief Gail Kimbell issued an interim directive for a new title to the Forest Service Manual (FSM); FSM 2000 – National Forest Resource Management, Chapter 2020 – Ecological Restoration and Resilience, which articulates foundational policy for restoration of National Forest System lands and associated resources. The policy guides achievement of sustainable management to continue providing a broad range of ecosystem services. Healthy, resilient landscapes would have greater capacity to survive natural disturbances and large-scale threats to sustainability, especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses.

Background and Existing Conditions

Forest and fuel conditions on the Seward Ranger District (SRD) of the Chugach National Forest have changed rapidly over the last twenty-five years. Since the late 1980s, a spruce bark beetle (*Dendroctonus rufipennis*) epidemic has severely impacted forest ecosystem structure, function, and dynamics. These changes also impact fish and wildlife habitat, recreation, hydrologic systems, and aesthetic properties.

Approximately 24%, or 223,000 acres, of the SRD consists of forested cover types. Slightly more than half of this forested area contains white spruce (*Picea glauca*) or a mix of spruce-mountain hemlock (*Tsuga mertensiana*) and spruce-hardwoods that are susceptible to beetle attacks. Latest estimates indicate that almost 71,000 acres or 63% of the spruce cover types, on the SRD have succumbed to these attacks. Spruce cover types contain combinations of white spruce, Sitka spruce (*Picea sitchensis*), and Lutz spruce (*Picea Lutzii*).

Fire History and Occurrence

The settlement period of the area began in the late 1800s and early 1900s. Fires were periodically set by miners and railroad workers, both intentionally and accidentally.

Lightning fires are extremely rare events on the SRD; however, ignition from recreation in the forest plays an important role. Between 1914 and 1997, 99% of fires were ignited by human actions (Potkin 1997). Most of these ignitions occur in WUI areas, including road corridors, campgrounds, and dispersed recreation sites.

Fire Regimes and Condition Class

Fire regimes are a generalized description of the role fire plays in an ecosystem characterized by fire frequency, predictability, seasonality, intensity, duration, scale (patch size), as well as regularity or variability.

Condition classes are a function of the degree of departure from historic fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, and stocking level. One or more activities can cause a departure in fire regimes such as fire exclusion, insects and disease, and past management activities (Schmidt, Menakis, Hardy, Hann, and Bunnell 2002).

The three condition classes are:

- Condition Class 1: Fire regimes are within an historical range. The risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range.
- Condition Class 2: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), resulting in moderate changes to one or more of the following: fire size, intensity and severity and landscape patterns. Vegetation attributes have been moderately altered from their historic range.
- Condition Class 3: Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historic frequencies by multiple return intervals, resulting in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Species composition and structure have been substantially altered from their historical range at patch and landscape scales. Insect and disease populations have been altered from their historic range.

SRD forest types are generally characterized as transitional between coastal rainforests dominated by Sitka spruce and drier interior forests dominated by white spruce. Historic fire regimes of the forest types found on the district can be characterized as high intensity, stand replacing events. Fire return intervals for these events are estimated to be approximately 600 years.

Ecosystem changes from the beetle epidemic have a direct impact on future vegetation within SRD. Within two years of attack, beetles have decimated individual spruce stands, evidenced by spruce mortality rates of up to 90%. The loss of mature seed bearing trees has a negative influence on stand dynamics and future desired conditions. As spruce trees die and rot, timber litter falls to the forest floor, increasing the fuel load. Increased fuel loads contribute to the potential for erratic, uncontrollable fire behavior. In addition, as the forest canopy opens due to spruce windfall, Bluejoint reedgrass (*Calamagrostis*

canadensis) invades the understory. This grass also has the potential to contribute to potentially intense fire behavior as a fine, flashy fuel.

Recent weather patterns indicate a warmer and drier climate across the Kenai Peninsula (Berg 2000). These patterns are not only conducive to beetle reproductive cycles, they are conducive to increased recreation on the SRD. Given changing weather patterns, high potential for ignition sources due to recreation, and increasing fuel beds with intense fire behavior, any forest types within SRD that contain a spruce component of at least 50% are considered Condition Class 3. The entire project area contains a spruce component greater than 50% and is considered Condition Class 3.

Vegetation Condition

The project treatment area is approximately 412 acres and consists mostly of spruce and patches of Paper birch (*Betula papyrifera*), with many dead downed and some standing dead spruce trees. The understudy consists of rusty menziesia (*Menziesia ferruginea*) or Devil's club (*Echinopanax horridum*) in the shrub layer. Existing dead and down woody surface fuels in the stand account for 50.5 tons/acre. Standing dead trees are not present in great quantities in the project area and have either fallen to the ground or have been utilized locally for firewood.

The present condition of the forest in the area today is most likely the result of a large stand replacing fire that occurred about 100 years ago and subsequent fire suppression. The stands are generally multi-storied and mixed species, with hardwoods dominating the overstory. The hardwoods are becoming decadent and some mortality is occurring. The gaps occurring due to mortality in the hardwoods and Lutz spruce (*Picea lutzii)* is filling with bluejoint reedgrass (C*alamagrostis canadensis)* in some cases, thereby creating a significant fuels hazard. When the Bluejoint reedgrass dies back each year, it creates a thick mat of fine fuels.

Table 1 describes the current vegetation condition and the desired future conditions for each unit in the project area.

Table 1 Current and Desired Future Condition for Each Unit

Unit	Current Condition	Desired Future Condition
1	In the portion of the unit located on the south- side of the Seward Highway there is a mixture of mature birch, Lutz spruce, and hemlock in the overstory. Bluejoint reedgrass is present and creating a fuels concern. Lutz spruce is present in the understory. Mortality is present in the spruce, but it is not extensive. Much of the current mortality has fallen to the ground. In the portion of the unit located north of Seward Highway there are areas of black spruce, as well as Lutz spruce and birch. Some mortality exists. This unit contains interlocking crowns and small trees that may act as "ladder fuels" promoting a ground fire to a crown fire. A fish bearing stream is present in this unit.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels near the Seward Highway. • No moose browse created within ¼ mile of the Seward Highway.
2	Unit contains a mixture of mature birch and spruce and decadent aspen. Bluejoint reedgrass and dead spruce become increasingly prevalent toward the west side of the unit. A significant component of small spruce (<3" DBH) is also present. This unit contains interlocking crowns and small trees that may act as "ladder fuels" promoting a ground fire to a crown fire.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels near the Seward Highway. • No moose browse created within ¼ mile of the Seward Highway.
3	A mixture of mature birch, Lutz spruce, and black spruce are present in this unit. Birch is generally declining within the stand. Some mortality among the Lutz spruce in this unit. This unit contains a fish bearing stream. Bluejoint reedgrass occurs rarely in this unit. This unit contains interlocking crowns and small trees that may act as "ladder fuels" to promoting a ground fire to a crown fire.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels near the Seward Highway. • No moose browse created within ¼ mile of the Seward Highway.
4	A mixture of mature birch and Lutz spruce, with a significant component of small hemlock in the understory present in this unit. Much of the mortality in this unit is downed and beginning to rot. No bluejoint reedgrass is observed in this unit.	• Keep bluejoint reedgrass to a minimum in this unit. Remove dead and dying trees so present and future horizontal fuel continuity is minimized.

Unit	Current Condition	Desired Future Condition
5	A mixture of mature aspen, birch, hemlock, and Lutz spruce is present. Small gaps are beginning to appear in the canopy and some are filling with bluejoint reedgrass. Gaps have been caused by mortality in Lutz spruce, which are thought to have been killed by spruce bark beetle (*Dendroctonus rufipennis*). Mortality occurred several years ago and most dead spruce trees are now on the ground. Gaps have also been created by mortality in birch. In many areas tree crowns are interlocking and small trees may act as ladder fuels.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels. • Vigorous stand is desired to improve resistance to forest insects and diseases. • No moose browse created within ¼ mile of the Seward Highway.
6	A mixture of mature hardwoods and Lutz spruce are present in the overstory. Lutz spruce and hemlock are most prevalent tree species in the understory. Bluejoint reedgrass is also present. There is a small amount of spruce mortality. In many areas tree crowns are interlocking and small trees may act as ladder fuels.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels throughout the unit. • Vigorous stand is desired to improve resistance to forest insects and diseases. • No moose browse created within ¼ mile of the Seward Highway.
7	A mixture of mature hardwoods and Lutz spruce are present in the overstory. A portion of this unit overlaps the Daves Creek Restoration Project. There is little mortality in this unit. A fish bearing stream is present in this unit.	• Bluejoint reedgrass kept minimal in this unit, dead and dying trees removed so present and future horizontal fuel continuity is minimized.
8	A mixture of species is located in this unit located along the Old Sterling Highway. Above the road, the unit is mainly comprised of old but small hemlock (av. DBH 8") and a fairly dense stand with interlocking crowns. The portion below the road contains small Lutz and black spruce and mature cottonwoods. Also, in areas of this portion of the unit it is a fairly open canopy, but other areas the canopy is dense with interlocking crowns.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels near the Old Sterling Highway.
11	This new unit was originally the northeast portion of Unit 1 and is a mixture of Lutz spruce, hemlock, and birch. Most of the unit is fairly open, does not need thinning. Some downed fuels are present.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Healthy residual stand, with limited fuel continuity.
12	This area was proposed for treatment during one of the public meetings held by the Forest Service. The unit is a mix of dense small spruce with some hardwoods between the Seward Highway and the powerline corridor. Beyond the powerline corridor the unit becomes more open, but clumps of small spruce exist. This unit contains a fish bearing stream.	• Minimal amount of bluejoint reedgrass and dead and dying trees. • Open canopy with minimal amount of ladder fuels near the Seward Highway • No moose browse created within ¼ mile of the Seward Highway.

Forest Plan Direction

The Chugach National Forest Revised Land and Resource Management Plan (2002) (Forest Plan) provides guidance for all resource management activities on the national forest. The Forest Plan uses Management Area (MA) prescriptions to provide direction for specific areas of the Forest. The MA prescriptions contain direction on the uses allowed, not allowed, or allowed subject to specific conditions.

The Tern Lake Hazardous Fuel Reduction Project proposes vegetation treatments in the Forest Plan MA 312 Fish, Wildlife, and Recreation Management Area.

MA 312 – Fish, Wildlife, and Recreation Management Area

Fish, Wildlife and Recreation Management Areas emphasize habitats for fish and wildlife species and year-round recreational opportunities in both developed and dispersed settings.

The proposed actions for this project are consistent with this MA prescription.

Decision Framework

The responsible official for this project is the Seward District Ranger. Given the purpose and need, the deciding official reviews the proposed action and the other alternatives in order to make the following decisions:

- Should fuels be reduced in the area?
- How much fuel should be reduced?

Public Involvement

The proposal was listed in the Schedule of Proposed Actions on January 1, 2009. The proposal was provided to the public and other agencies for comment during scoping for 30 days starting November 17, 2009. In addition, as part of the public involvement process, the agency hosted two public meetings on December 17, 2009 and January 28, 2010 at the Moose Pass Community Center. Fifteen members of the public attended the two public meetings where questions and comments were received. Two written comments were received during the scoping/comment period beginning November 17, 2009 and ending December 16, 2009. Ten more written comments were received following the end of comment period. All comments regarding the project were considered.

Issues

The Forest Service identified several topics raised during both internal and public scoping. These issues include:

- Protection of soil resources:
  - Soil disturbance from mechanical equipment;
  - Competition for tree establishment from bluejoint reedgrass
- Protection of wildlife resources
  - Disturbance of breeding migratory birds during implementation

  - Vehicle mortality of moose through promotion of early seral hardwoods (browse) within ¼ mile of the Seward and Sterling Highways
  - Screened foraging habitat for bears near Tern Lake Creek
- Protection of fisheries resources
  - Disturbance to vegetation and soils near fish bearing streams: Daves Creek, Tern Lake Creek and Moose Creek
- Protection of sensitive plant species
  - Disturbance to pale poppy population during implementation
- Controlling the introduction or spread of invasive plants
- Protection of water resources
  - Disturbance to vegetation and soils near Daves Creek, Tern Lake Creek, Moose Creek and Moose Creek Tributary
- Protection of recreation/scenery resources
  - Altering the natural appearance of vegetation along the Seward Highway corridor
  - Altering visual appearance along the Tern Lake Day Use Area, Hannisford Road, and the Swimming Hole in Unit 2
  - Unauthorized access by ATV use following implementation
- Limiting availability of personal use firewood as a result of implementation

Each of these issues will be addressed in the proposed action or with design criteria that control or modify how any actions are implemented.

Alternatives

No Action, Alternative 1

Under the No Action Alternative, current management plans would continue to guide management of the project area. No hazardous fuel treatments would be implemented to accomplish project goals. The No Action Alternative would not decrease the risk to life and property from wildfire for the residents and visitors of Moose Pass. The No Action alternative would not decrease potential fireline intensity required for reasonable fire suppression or reduce the likelihood of fire carrying outside the project area.. The No Action Alternative would not reduce fire intensity if a wildfire were to burn the project area, increasing the risk for a stand replacing fire and damage to watersheds, scenic integrity and wildlife habitat.

The Proposed Action, Alternative 2

The Proposed Action would reduce hazardous fuels on NFS Lands of the Chugach National Forest in the Moose Pass Wildland Urban Interface (WUI).

Specific actions proposed by the Forest Service to meet the purpose and need include various combinations of treatments on about 412 acres of NFS lands near the community of Moose Pass. Treatments include the removal of dead downed, dead standing, dying, and unhealthy trees and burning or chipping residual slash to reduce the existing fuel loads. Figure 1 shows a map of the Tern Lake Project treatment units. The project area

includes twelve treatment units. Table 2 outlines the specific actions prescribed for each unit. Table 3 provides key definitions for proposed treatments, while Table 4 outlines resource protection and design criteria for the proposed action.

The Tern Lake Fuel Reduction Project was designed with the following goals:

- To Protect People and Property- To propose activities that will decrease the risk to life and property due to wildfire for the residents and visitors of the Moose Pass area.
- To Decrease Fireline Intensity - To propose activities that will decrease potential fireline intensity in order that reasonable fire suppression activities can be employed.
- To Reduce Risk of Resource Damage - To propose fuel reduction activities that will reduce fire intensity and the likelihood of fire carrying outside the project area in order to reduce watershed, visual and wildlife habitat damage associated with wildfire and to propose activities that encourage growth of the remaining trees toward larger size classes that were lost as a result of spruce bark beetle mortality.

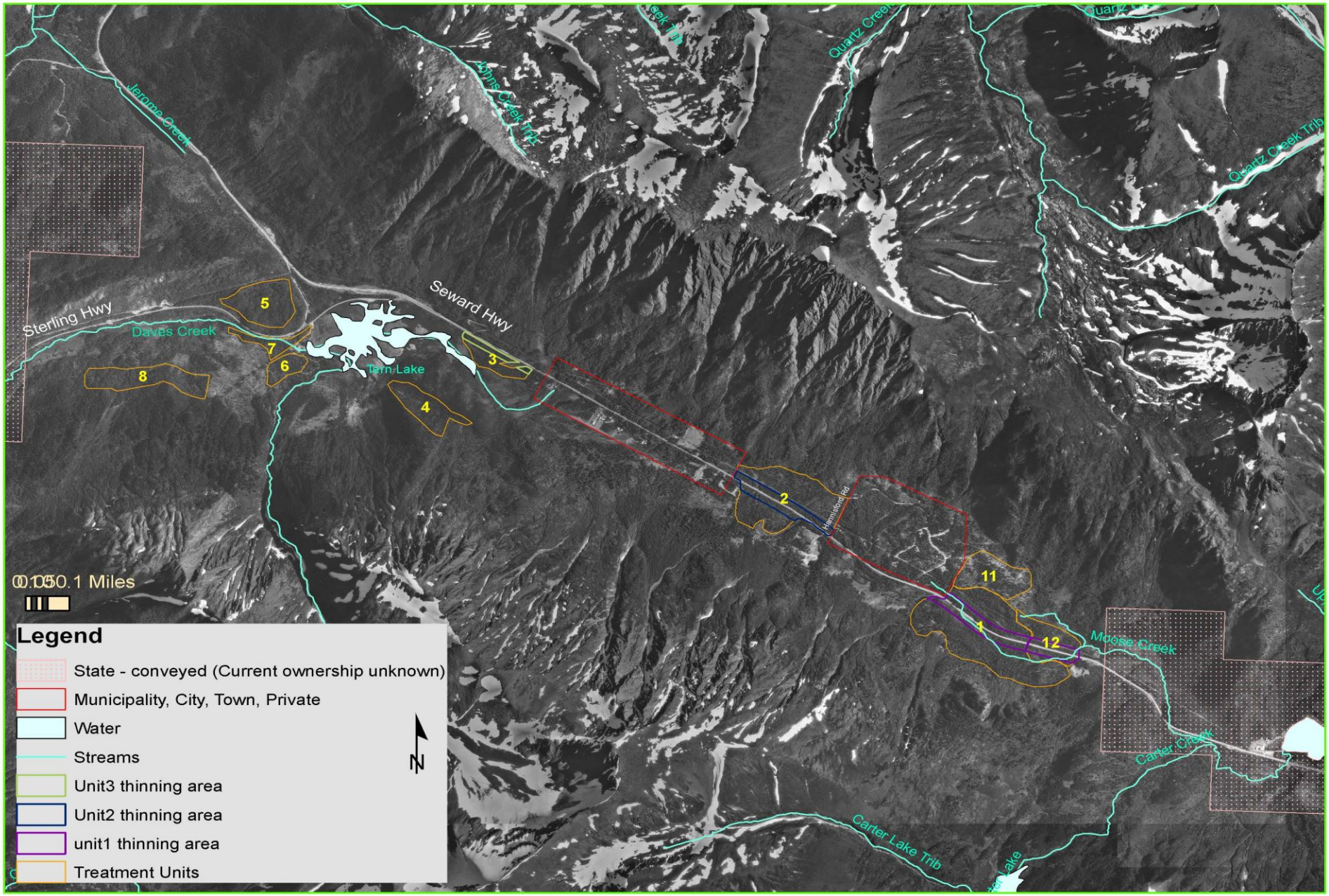

Figure 1 Tern Lake Treatment Units

Table 2 Proposed Treatment Table

Tern Lake Hazardous Fuel Proposed Treatment Table				
Unit	**Acres**	**Treatment**	**Method**	**Resource Protection and Design Criteria**
1	120	FUEL, THIN, CHIP (THIN + North Hwy), PILE (South Hwy only)	HAND/MECH	BUF, FG, FS (THIN + North Hwy only), SNAG, WEED
2	84	FUEL, THIN, CHIP	HAND/MECH	FG, FS, SNAG, WEED
3	19	FUEL, THIN, CHIP	HAND/MECH	BUF, FG, FS, SNAG, WEED
4	27	FUEL, PILE	HAND	SNAG
5	36	FUEL, THIN2, PILE	MECH	FG, SNAG, WEED
6	12	FUEL, THIN2, PILE	MECH	FG, SNAG, WEED
7	12	FUEL, PILE	MECH	BUF, FG, SNAG, WEED
8	38	FUEL, THIN2, PILE	HAND	SNAG
11	35	FUEL, CHIP	HAND/MECH	FG, FS, SNAG, WEED
12	29	FUEL, THIN, CHIP	HAND/MECH	BUF, FG, FS, SNAG, WEED

Table 3 Proposed Treatment Codes and Definitions

Tern Lake Hazardous Fuels Project Codes and Definitions	
Vegetation Treatment	
FUEL	Treatment includes removal of dead and dying standing spruce, and dead downed surface fuels. Treatment would increase probability of fire suppression by minimizing accumulation of surface fuels and reducing the probability of rapid fire spread near potential points of ignition (roads).
THIN	Thinning of spruce less than 5" diameter breast height (DBH) would initially be a DBH + 3’ bole (trunk) spacing within 200’ of the Seward Highway and Hannisford Road. For example, a 4” DBH spruce tree would have a spacing of 4’ + 3’ = 7 feet; a 8" DBH spruce tree, 8’ + 3’=11 foot spacing. Thinning would increase probability of fire suppression by minimizing accumulation of surface fuels, removal of ladder fuels, reducing risk of torching and crown fire near the highway, and by minimizing the spread of bluejoint reedgrass, a flashy fuel in dry conditions. Monitoring of this treatment may result in the need to further thin spruce less than 5” DBH, but would not exceed a 15’x 15’ bole spacing within 200’ of the Seward Highway and Hannisford Road.
THIN2	Thinning of spruce less than 5" diameter breast height (DBH) by 15' x 15' bole (trunk) spacing, with some flexibility in spacing so the most vigorous trees may be retained. Thinning would increase probability of fire suppression by minimizing accumulation of surface fuels, removal of ladder fuels, reducing risk of torching and crown fire near the highway, and by minimizing the spread of bluejoint reedgrass, a flashy fuel in dry conditions.
CHIP	Surface fuels and slash generated by thinning, removal of ladder fuels, and dead/dying standing trees would be treated by mechanized mastication/chipping methods where possible and practical, as an alternative to piling and burning of the material. See also MECH.
PILE	Surface fuels and slash generated by removal of dead/dying standing trees less than 3" diameter would be treated by piling and burning of material.
HAND	Treatment would be accomplished by hand crews unless otherwise noted in MECH.

Tern Lake Hazardous Fuels Project Codes and Definitions	
Vegetation Treatment	
MECH	Treatment would be accomplished by mechanized equipment in south side of Unit 1, and throughout Units 5, 6, and 7. For the north side of Unit 1, throughout Units 2, 3, 11, 12, and all 200' thinning areas next to the Seward Highway and the Hannisford Road, mechanized treatment refers only to use of a masticator/chipper, otherwise work is accomplished by hand crews.

Table 4 Resource Protection and Design Criteria

Resource Protection Measures and Design Criteria	
BUF	No disturbance/treatment riparian buffer within 100 feet of streams with fish populations in order to provide stream protection, maintain the natural flow regime, maintain integrity of the riparian buffer to filter sediment and other pollutants, maintain natural channel integrity to protect aquatic habitat and other beneficial uses, and prevent adverse changes to the natural stream temperature regime.
FG	Mechanized equipment treatments would occur over frozen ground (minimum 3 inches frozen ground) or over snow to minimize soil disturbance.
FS	Treatment within 200 foot buffer of Seward Highway and Hannisford Road would be accomplished by Forest Service personnel and equipment in order to allow adaptability in rate and degree of treatment where visuals are a concern.
SNAG	Four snags per acre and 50 linear feet of down logs per acre would be retained according to Chugach Forest Plan guidelines for vegetation management.
WEED	All mechanized equipment would be cleaned and free of dirt and plant materials before entering the project area in order to prevent the spread of non-native plants.

The proposed actions would result in the following:

- Fuel conditions that allow for efficient and safe suppression of wildland fire ignitions during initial attack.
- Increasing success of initial attack through thinning of stands near the Seward and Sterling highway.
    - Secondary benefit of encouraging growth of the remaining trees toward larger size classes for increased structural diversity and improvement of existing wildlife habitat.
- Removal of dead standing material, which increases fire fighter safety.
- Flame lengths at the head of the fire that are less than 4 feet in the WUI during 90th percentile weather conditions, allowing direct attack with hand crews
- Move the Project area toward Condition Class 1 and FBPS (fire behavior prediction system) Fuel Model 8.
- Firewood from thinning and harvesting operations would be made available for both commercial and personal uses.

Project Specific Design Criteria

The Proposed Action includes the following resource design criteria:

Design Criteria for Soil Resources

- All mechanical units would be done over snow (at least two feet of snowpack) or three inches of frozen ground.

- Stands should not be opened to more than 40 percent canopy closure to minimize competition of bluejoint reedgrass with tree regeneration.

Design Criteria for Water/Fisheries Resources

The following design criteria for the Proposed Action would help ensure that water resources are protected within and downstream of the project area.

- Applicable Best Management Practices (BMPs) should be followed during timber operations, as stated in the Region 10 Soil and Water Conservation Handbook (USDA Forest Service, Alaska Region, 2006).
- No thinning should occur within 100 feet of Daves Creek, Tern Lake Creek, Moose Creek, or the Moose Creek tributary, as described in Best Management Practices 12.6a and 13.16 (USDA Forest Service, Alaska Region, 2006). Exceptions to this measure can be made where the prescribed thinning would also improve riparian function.
- No thinning or removal of downed spruce should occur within the stream corridor constructed for the Daves Creek Stream Restoration Project. Prior to conducting any thinning activities that would occur within 100 feet of Daves Creek or its side channels, a more detailed plan for protecting the stream course should be developed and the Forest hydrologist should be consulted.
- To minimize potential impacts to wetlands, areas of mapped wetlands within the treatment units should be avoided during the proposed activities (Figure 2).

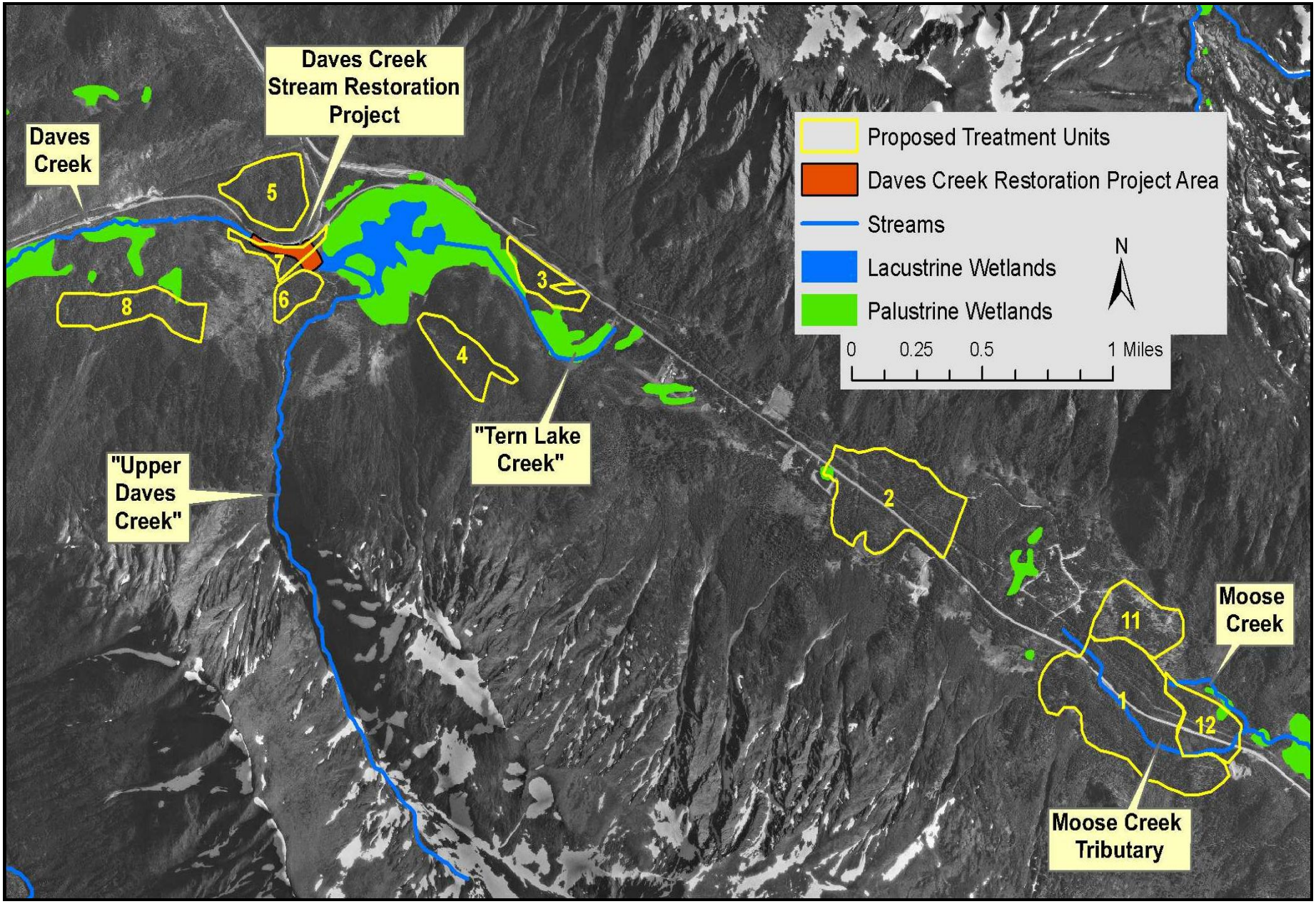

Figure 2 Wetlands within the Project Area

Design Criteria for Plant Resources

The following design criteria would reduce impacts to this population and other sensitive species and habitat within the project area.

- Map and mark existing population of pale poppies prior to treatment activities to ensure chip or burn piles are not located directly on the population.
- Monitor existing population of pale poppies to determine how proposed activities are impacting the species. Additional mitigation measures may be recommended if monitoring shows negative impacts to the species.
- If any previously undiscovered sensitive plants are encountered at any time prior to or during implementation of this project, protect the population and avoid any disturbance in the area containing the population (and similar habitats in that vicinity). The Seward District or Forest Botanist/Ecologist should be notified immediately to evaluate the population and recommend avoidance or mitigation measures.
- For all projects involving revegetation, use natural revegetation where seed source and site conditions are favorable, or use native plant species in revegetation/restoration projects when natural revegetation conditions are not favorable (Forest Plan page 3-25). Preference should be given to plant materials from the local environment of the project area to maximize adaptation to that environment and maintain local genetic composition.
- In areas where future ground disturbing activities are scheduled to occur within invasive plant infestations, appropriate invasive plant treatment applications should be conducted prior to project implementation to reduce future spread and establishment. Ideally, ground disturbing activities should be timed to minimize the potential of providing favorable seed beds when invasive plant species have developed mature seeds.
- Prior to entering National Forest land, agency personnel, permittees, and contractors are required to clean the equipment they intend to use. Equipment should be free of dirt and plant materials. Similarly, when working on trails, the cleaning of tools and equipment between work sites along the trail would help prevent transport of invasive plant seed.

Design Criteria for Wildlife Resources

To reduce the impacts that would occur due to project activities the following design criteria should be followed:

- Follow Forest Plan guidelines for buffer zones around any new goshawk, bald eagle, or swan nests found in or adjacent to the project area. If these species or their nests are noted in the project area, notify the district biologist immediately.
- Conduct vegetation clearing operations outside the breeding season of migratory birds (May 1-July 15) whenever possible to reduce loss of reproduction during that year. While most units would be treated mechanically in the winter, hand work in Units 4, 8, and on the boundaries of Units 1, 2, and 11 may affect migratory birds.
- Do not promote large areas greater than .25 acres of early seral hardwoods within ¼ mile of the highway to discourage moose from crossing the highway to reach browse.

- Leave a 100' no cut buffer zone adjacent the stream in Unit 3 to provide screened foraging habitat for brown bears.

Design Criteria and Monitoring for Heritage Resources

- Post-project monitoring would take place in any treatment units that are chosen for mechanical treatment.

Design Criteria for Scenery Resources

- Vegetation treatments should be designed and implemented in such a way that they maintain or enhance desired scenic values, with the highest emphasis place on foreground scene areas from the Seward Highway. Thinning adjacent to the Seward Highway should be a diameter plus three prescription within 150 feet of the highway right-of-way.
- Shape, blend and orient treatment units in a manner that is natural appearing and would not draw attention of an average forest visitor when the project is completed.
- Stumps should be cut as low as possible, generally less than 6", in areas visible from the Seward Highway.
- Leaving untreated slash or crushing slash without follow up treatment is considered incompatible with scenic values. Slash treatment should generally be completed within one year in areas adjacent to the Seward Highway.

Design Criteria for Recreation Resources

- Sign areas along Seward Highway while activities are taking place to inform users of activities if activities impact the highway corridor visually.
- Maximum stump height should be less than 6" on the high side within 50' of the viewed areas along roads and trails.
- Locate burn piles out of viewed areas along roads and trails;
- Chip and remove all slash within the immediate area of the Tern Lake Day Use Site.
- Close all skid trails and accesses after activities are completed within each unit.
- Fuel reduction activities would be conducted between September 15th and May 15th within Units 6, 7, 4 (only within the viewshed of the Seward Highway) and adjacent to the Swimming Hole in Unit 2 to avoid conflicts with forest visitors;
- Exclude the area between the Seward Highway and the Swimming Hole at Mile Post 35.5 in Unit 2.
- Adjacent to the Tern Lake Day Use Site parking area (unit 6 and 7), leave a 50 foot buffer where mechanical treatment will be excluded. Selectively mark and hand thin this area following mechanical treatment, with assistance from the Recreation Specialist.
- Patrol access points for unauthorized ATV use for 2 years or until vegetation closes in.

Environmental Impacts

The environmental impacts of the Proposed Action and the No Action are summarized in this section. The environmental analysis focuses on those species or resources most likely to be affected by the Proposed Action or No Action alternatives or those that the Forest Plan and Forest Plan EIS identify as being relevant to hazardous fuel reduction projects. More detailed information about the affected environment and environmental effects are available in the specialists' reports in the project file maintained at the Seward Ranger District, Kenai Lake Work Center.

Fuels

Alternative 1, No Action

Effects

The Fuels Management Analyst (FMA) suite of software was used to analyze fuel loads and resultant fire behavior under various weather and treatment scenarios. FMA (FPS 1999) is a research and analysis tool used for conducting fire behavior analysis and uses the 13 standard FBPS (fire behavior prediction system) fuel models (Albini 1976, Anderson 1982, Rothermel 1972) Variants on these models also depict high or low fuel loads and fuelbed depths. These variants were used as a measure to display general changes in fuel profiles and subsequent fire behavior.

Weather parameters used to run FMA represent the 90th percentile weather conditions, a common threshold used in the fire management community to identify unusual weather conditions where complex fires are expected with potential for extreme fire behavior. These values were derived from the Kenai Lake weather station located near the project area with averages taken over a 30-year period between May 1st and July 15th, the period when most wildfire ignitions occur on the Kenai Peninsula.

The existing condition in the project area can be described in terms of FBPS Fuel Model 10 (Table 5), which would persist under the no action alternative. FBPS Fuel Model 10 is a timber fuel model where canopy litter-fall is the primary fire carrier with a fire that burns in the surface and the ground fuels with greater fire intensity than the other timber litter models. Dead down fuels include greater quantities of 3 inches or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Crowning, spotting, and torching of individual trees would be more frequent in this type of fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy sown material is present; for example insect-or disease-ridden stands with deadfall (National Wildfire Coordinating Group 1992).

Existing fuels in the project area include an average of 50.5 tons/acre of dead down woody material with a minor amount of standing dead material that would persist under the no action alternative. Given existing fuel loads and vegetative conditions, potential wildland fire behavior under 90th percentile weather conditions exceeds the capability of direct attack by hand crews, as exhibited by flame length of 7.0 feet (Table 5). Flame lengths less than 4 feet are necessary for direct attack. Flame lengths of 7.0 feet approach

moderate intensity and indicate potential for torching, spotting, and crowning. Large downed woody debris would impede fire fighters abilities to attack the fire, causing resistance to control. Where large debris crosses potential fire lines, line construction would be slowed when using hand or mechanical means.

Table 5 Estimated Fire Behavior for the Tern Lake Project Area with No Treatment

	FBPS Fuel Model	Flame length[1,2]	Rate of spread[1,2]
No Action Alternative	10 (FBPS)	7.0	16.6

[1] Flame lengths are in feet, rate of spread is in chains per hour (1 chain = 66 feet).

[2] Flame lengths and rate of spread under 90th percentile weather and fuel moisture conditions for the Kenai Peninsula. (Wind: 20 mph; temperature: 73 F; moisture of 10 hour fuels (0.25" – 0.99"): 8 percent).

Alternative 2, Proposed Action

Effects

Proposed treatments would change the quantity and continuity of fuels, removing the majority of dead and down woody material by piling and burning the material or by chipping the material into small pieces that will allow quick decomposition. Fire behavior modeling demonstrates that flame lengths and fireline intensities would be reduced after treatment should a wildfire occur during 90th percentile weather conditions (Table 6). Flame length would be reduced below 4.0 feet and fireline intensities reduced under the proposed action allowing for direct attack by hand crews and providing firefighters an opportunity to safely suppress most wildland fire in and adjacent to the WUI.

The proposed action would move the FBPS Fuel Model from 10 toward 8 (Table 6). FBPS Fuel Model 8 can be described as: slow burning ground fires with low flame heights are the rule, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidity, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand. Representative conifer types are Spruce and Hemlocks. (National Wildfire Coordinating Group 1992)

The proposed action would also move the project area toward Condition Class 1, reducing fire size, intensity, and severity which would result in lowered risk of loss of infrastructure from wildfire. Moving the project area toward Condition Class 1 would return fire regimes to their historical range and lower the risk of losing key ecosystem components.

Removing activity fuels (slash generated from all activities) would reduce the potential of additional fuel loading along higher ignition source areas, such as the highway. Removal of standing dead spruce trees would have an immediate and positive affect for fire fighter safety from injury due to falling snags.

Table 6 Estimated Fire Behavior for the Tern Lake Project Area with Treatment

	FBPS Fuel Model	Flame length[1,2]	Rate of spread[1,2]
No Action Alternative	10 (FBPS)	7.0	16.6
Proposed Action	8 (FBPS)	2.5	4.7

[1] Flame lengths are in feet, rate of spread is in chains per hour (1 chain = 66 feet).

[2] Flame lengths and rate of spread under 90th percentile weather and fuel moisture conditions for the Kenai Peninsula. (Wind: 20 mph; temperature: 73 F; moisture of 10 hour fuels (0.25" – 0.99"): 8 percent).

Soils

Alternative 1, No Action

Effects

Current soil chemical, biological, and physical processes, such as humus formation and podzolization, would continue in the project area under the No Action Alternative. Woody biomass loading in the project area is currently 50.5 tons/acre, which is the result of accretion of dead spruce falling to the ground after the recent spruce bark beetle attack. The current woody debris loading and subsequent decomposition presents two new questions:

First, what would be the effect of coarse woody debris loading on the nitrogen cycle, i.e., would there be a nitrogen bottleneck in the soil from nitrogen immobilization because of a relatively rapid rise in the carbon to nitrogen ratio (C:N). On upland sites, 30 to 60 tons per acre, while not extreme, is on the high end to somewhat outside the range of natural variability of woody debris on the ground in some similar forest types (Graham, et al. 1994). Coarse woody debris loading might raise the C:N from around 15-20 (depending on depth and horizon) to about 25-30 or higher. The upper-end estimate of woody debris (carbon) could cause a moderate immobilization of nitrogen, and a reduction in nitrogen availability to plant roots and other organisms. This effect could last a few decades unless there was a ground-clearing fire, which would more or less reverse the effects of heavy carbon loading, although there could also be different, undesirable effects. Other biogeochemical changes could also occur during this fuel loading period, include a lowering of pH, an increase in mobile aluminum, and a shift in soil food-web organisms toward fungi with a decline in bacteria. Long-term (late successional), once C:N declines to a more normal range through decay and transformation processes, the soil biogeochemical processes and the soil and plant community would be expected to function again within the natural range of variation (DeLuca 2000; Norton 2000).

The second question, would there be an increased effect on soil and watershed due to burn severity in the case of a wildfire some twenty to thirty or more years out. Soil heating and the amount of bare ground exposed from surface organic matter consumption are the main effects that I would be concerned about from fire on high fuel loaded sites. Severe fire effects can potentially lower soil productivity and cause or increase erosion and sediment.

In the No Action Alternative, under the current woody debris load, a fire during high fire danger (an unusually dry, warm segment of the summer) might consume half of the forest floor litter layer and about 15 percent of the soil surface would be expected to be exposed. At no depth would soil heating reach 60° degrees C, slightly below the threshold temperature at which nitrogen is volatilized, and well below the threshold temperatures that would kill nitrifying bacteria and other organisms.

Under the same woody debris scenario but in a 200-year fire event (i.e., historic, very dry conditions), the fire might consume most of the litter layer and expose about 80 percent of the surface soil. After twenty to thirty years of additional fuel loading from the dead overstory, these effects would be expected to be amplified. Under this scenario, soil heating of 60° C could reach down to about 9 cm, and at 1 cm depth the temperature could reach 275° C, hot enough to volatilize all the nitrogen from the surface 1 cm; consume all soil organic matter; kill all bacteria and fungi; and begin to affect soil physical components including wettability and structure (DeBano, Neary and Ffolliott 1998). Recovery from these heating effects can take from about three to seven years for minimal soil organism re-population, to more than a century for the soil organic carbon (Dumeroese Jurgensen, and Harvey 2003; Tiedemann and Woodard 2002; Neary, et al. 1999). Post-burn large woody debris, needed for maintenance of soil organic matter, would be reduced in all fire scenarios, but would only be a problem under the severe (200-year) fire. Physical effects leading from the severe fire would likely include soil erosion, potential sediment delivery, and a potential reduction in soil quality and productivity.

Cumulative Effects

There are no other foreseeable activities on these activity areas so all effects would lead from the potential direct or indirect effects from fuel loading.

Alternative 2, Proposed Action

Direct/Indirect Effects

Soil effects from heavy equipment traffic cause compaction, displacement, mixing, rutting, and loss of structure and pore space. Secondary effects include erosion, reduction of water holding potential, and reduction of plant cover and/or growth (Block, Van Rees, and Pennock, 2002). Soil effects can also occur from burning, which are generally negative but sometimes positive. Direct effects from other activities, such as piling, are minimal, but indirect effects can often be relatively severe, such as fire effects from burning a pile. The range of effects varies widely depending on ambient conditions. For example, soil moisture status affects the degree of impacts as does slope, elevation (soil temperature), organic carbon content, as well as the soil type itself. Heavy equipment on wet soils causes rutting and puddling, which is loss of structure. On dry soils, effects are generally minor although displacement occurs more easily. On moist soils, at the peak of the moisture-density (Proctor) curve, compaction occurs with little force.

When equipment use is limited to frozen ground or to snow pack conditions, soil effects are limited or absent. In this project, all mechanical (excavator with processing head) and masticating/chipping units (units 1, 2, 3, 5, 6, 7, 11, and 12) would be done over snow (at least two feet of snowpack) or three inches of frozen ground. These conditions are

known to prevent all or almost all soil disturbance from previous activities on other sites. Hand treatment units (4 and 8) are expected to have no soil disturbance.

Some of the habitat types that occur in the project area currently have or have the potential to be dominated by bluejoint reedgrass, *Calamagrostis canadensis.* Bluejoint is rhizomatous and typically grows in dense stands with few other upper, mid, or lower layer species. In timber stands where bluejoint currently or potentially exists in the understory, opening the stand would likely increase the ground cover of bluejoint. While bluejoint is a very good ground cover from a soil erosion perspective, it limits the site from a diversity perspective, including the belowground component. For this reason, physical disturbance is sometimes necessary to allow for tree regeneration. Because of the dense cover provided by bluejoint, erosion from limited ground disturbance is usually not a concern. Also, it is relatively difficult to compact soil that has heavy bluejoint cover because of its thick, sod-like rooting habit. Thus, disturbance of soil in bluejoint reedgrass cover is not expected to result in detrimental soil disturbance of the types that are considered problematic in the Forest Service soil quality standards. To further mitigate the potential for tree regeneration, stands should not be opened to more than 40 percent canopy closure (Schulz 1998).

Piling trees is not expected to disturb soil, because piling would either be done by hand or machine piled over snow or frozen ground. Burning large piles with large wood can cause high soil temperatures and severe soil burn intensities causing sterilization and even mineralogical changes to the soil below the piles, drastically reducing productivity (DeBano, Neary, and Ffolliott, 1998). These effects can persist for years. The area comprised by burned piles is expected to be less than 1 percent of the activity areas. In addition, large woody debris would be limited in these stands; most debris would be branches and small wood. Burning can also be mitigated by constructing small piles less than five feet high.

Some units have been targeted for debris chipping rather than burning, if feasible (units 1, 2, 3, 11, and 12). Fuels managers estimate that up to 10 tons per acre would remain on the ground following chipping treatment. Heavy inputs of wood alter the carbon to nitrogen ratio in the soil which affects soil chemistry and productivity. Very large amounts of carbon incorporated into the soil would increase soil organism's demand for nitrogen, leaving plants in a deficiency situation. This is more of an issue with fine debris than with coarse woody debris, which decomposes more slowly. Though chipped logging debris would be relatively fine pieces, ten tons is not expected to show an impact as this amount is a relatively small input relative to the high existing loading and soil organic carbon content in these soils (Cryorthods, Borosaprists, and Cryaquepts).

Cumulative Effects

These are small treatment units on generally low-angle slopes with major operations conducted during winter, and are not expected to have any off-site effects from erosion. Equipment operations would occur over frozen ground and/or snowpack. Ground disturbance would be minimal up to about two percent from burn piles and landings, and cumulative ground impacts are not expected. This project is not expected to add to any current or foreseeable project in the activity areas or in the watershed.

Wildlife

Alternative 1, No Action (waiting on Mandy to determine need)

Direct Effects

No direct effects are expected.

Indirect Effects

Fire risk may increase as more trees die from spruce bark impacts, increasing standing dead fuel, and ground fuel as trees fall. Human caused fires may spread from the highway or community, which could destroy wildlife habitat for some species in the short term, or change habitats to early seral communities. Some aspen stands are dying out, and would be replaced by spruce, reducing habitat diversity for a variety of species.

Cumulative Effects

Cumulative effects include additional risk of wildfire in wildlife habitat for species that use mature or old growth conifer or mixed conifer/hardwood habitats. The risk of loss of infrastructure has increased throughout the Seward Ranger district in areas where no action has been taken to reduce fuels or where access, cost, or topography makes fuel reduction infeasible. If a wildfire were to occur, this might affect individuals, but effects would likely be limited in space and time due to fire suppression. It is unlikely that the small scale of the affected area would impact populations of any species on the Chugach National Forest.

Alternative 2, Proposed Action

Direct Effects

Disturbance would occur during treatments from noise, people, machinery, chainsaws, or vehicles to most wildlife species. Disturbance may cause habitat abandonment or avoidance during treatments. In units 4 and 8, and on the boundaries of units 1, 2, 3, 11, and 12 hand treatments may affect up to 100 acres during the summer during the breeding season of migratory birds. If so, treatments may affect nesting birds using snags or live trees. If the nest tree is cut, or crushed by treatment activity it may cause injury or death to nestlings.

Indirect Effects

Fire risk may increase as more trees die from spruce bark impacts, increasing standing dead fuel, and ground fuel as trees fall. Human caused fires from spreading from the highway or community could destroy wildlife habitat for some species in the short term and change habitats to early seral communities. Treatments would reduce this fire risk to wildlife habitats, helping to maintain important habitat components of mature vegetation and structure. On the other hand, cutting of dead trees would cause short term reduction of habitat for birds, bats, or small mammals that nest, roost, or forage in or on snags.

Vegetation treatments that thin intermediate and suppressed trees and open the understory while maintaining the canopy closure should promote the growth of larger trees and promote conifer or mixed forests in the long term, rather than hardwood forests. This would benefit species that prefer mature or old growth conifer or mixed forests. Some

patches of early seral birch and aspen may result in selected areas which would help maintain these species in the units over time as well as promoting habitat diversity. Small patches of hardwood re-generation may provide some moose browse but are unlikely to attract new moose to the area because the areas are small (personal communication with Jeff Selinger, ADFG, 2009). Treatments promoting conifer stands over the long term, and retaining canopy cover to reduce sun which can stimulate hardwood regeneration would benefit moose indirectly. Treatments are designed so as not to attract moose to units within ¼ mile of the highway.

Cumulative Effects

The project would cause short term cumulative impacts to MIS, SSI (Species of Special Interest), and migratory birds and their habitats due to vegetation removal and disturbance from project activities in conjunction with other past, present, and foreseeable activities listed in Table 5. Project actions would also contribute to beneficial cumulative effects of reduced wildfire risk to habitats. Although this would affect individuals, effects would be limited in space and time. It is unlikely that the small scale of the operation would impact populations of any species on the Chugach National Forest.

Table 7 Wildlife Cumulative Effects

Activity	Activity Timing	Relation to Project	Comments
Daves Creek Restoration	complete	Adjacent to project area	This project was designed to restore the riparian conditions and reduce impacts the highway. Cumulative effects from no action would be maintenance of fish and wildlife habitat and riparian condition.
Spruce Bark Beetle infestation	ongoing	Throughout the district, adjacent to the forested project areas	Affects mostly overstory and understory vegetation, causes changes in habitat conditions and habitat loss for some old growth dependant species. Removal of all vegetation would contribute to loss of more mature trees.
Development	ongoing	Adjacent to project area	Ongoing activity related to traffic and home development,
Recreation	ongoing	Adjacent to project area	Ongoing activity related to community use of adjacent trails and Tern Lake.
Firewood cutting	ongoing	Adjacent and in project area	Ongoing activity related to community needs for firewood.
Fuel Reduction/Habitat Improvement Projects	ongoing	Throughout the district in forested areas. Nearby projects in Quartz and Daves Creek and adjacent to Trail Lake and Moose Pass.	Affects mostly over story and understory vegetation, and causes changes in habitat conditions and habitat loss for species that use snags and dead and down. Treatments during the breeding season affect nesting birds.

Effects on Federally Threatened, Endangered, Proposed, or Candidate Species

No threatened, endangered, proposed, or candidate species or their existing or potential habitats, occurs within the proposed project area or within adjacent areas that could be affected by project activities. There would be no direct, indirect or cumulative effects to these species. See the Biological Evaluation in Appendix A for more detail.

Effects on Sensitive Species

No sensitive species or their existing or potential habitat occurs within the proposed project area or within adjacent areas that could be affected by project activities. There would be no impact, or direct, indirect or cumulative effects to *sensitive species.* See the Biological Evaluation in Appendix A for more detail.

Effects on Management Indicator Species

Brown bears and moose travel and forage in the project area. Direct effects from disturbance may cause short term habitat avoidance or displacement. Mitigation measures to leave a 100' buffer zone adjacent to anadromous streams would reduce disturbance to foraging animals

along stream corridors and help provide screened foraging habitat for bears and other birds and small mammals feeding on fish.

Indirect effects include long term habitat change toward mature conifer forests with lower wildfire risk. This would maintain or provide cover for both species without enhancing moose browse near the highway.

Effects on Species of Special Interest

Direct effects from disturbance may cause short term habitat avoidance or displacement by all species and long term habitat change toward mature conifer forests with lower wildfire risk Removal of small conifers may reduce habitat for snowshoe hares and therefore reduce foraging habitat quality for lynx. Removal of large dead and down trees may also reduce potential denning sites. Treatments that promote growth of larger trees and protection of mature and old growth forests from fire risk would benefit Townsend's warblers and goshawks over time. Treatments would likely have little effect on wolves or wolverines except for some avoidance of the area during treatment. These species forage over large areas, and the project area represents a small portion of their territories. Avoidance of the area during operations would not likely substantially affect their foraging opportunities. Bald eagles should be minimally affected, because all known nests are outside the units and beyond 330'of planned operations. Eagles primarily use Tern Lake for foraging, which is not affected by project operations. Eagles may forage on other species besides fish and waterfowl that occur in the units so operations may discourage some foraging opportunities. River otters may have travel corridors that run through units adjacent to Tern Lake. Otters may avoid these areas or be displaced during operations. Leaving 100' buffers along anadromous streams would reduce disturbance to otters using streams and adjacent upland areas.

Effects on Migratory Birds

Migratory birds nest and forage throughout the units. Vegetation removal that occurs during the breeding season (potentially in Units 4 and 8 and on the boundaries of 1, 2, 3, 11, and 12) may cause loss of nests and chicks due to losses of nesting habitat in trees and shrubs during vegetation removal.

Individuals that are species of concern may be affected in the short term during treatments. This is unlikely to affect populations. The species listed are declining either throughout their range, or have declining populations in Alaska.

Fisheries

Alternative 1, No Action

Effects

In the absence of a natural fire regime or periodic fuel reduction program, federal lands adjacent to private lands (WUI) have a higher probability of future fire suppression needs. Aggressive fire suppression and post fire suppression rehabilitation frequently mobilize hand crews and equipment to first construct and later rehabilitate fire containment lines. The potential loss of vegetation and soil cover, and short-term adverse impacts to fish bearing streams is expected as part of a normal disturbance-dependant riverine system typical of Kenai River watersheds. However, absent a fuel reduction program, there is increased risk of

resource damage above that expected from natural fire disturbance. Present fuel loads (50 percent in Condition Class III) present a scenario for a more intense and longer duration burn, as well as increased likelihood aggressive fire suppression efforts within a WUI area would be needed.

Alternative 2, Proposed Action

Effects

No foreseen effects from the proposed action alternative to salmon species or resident fish species due to the proper implementation of 100-foot stream buffers and proper application of applicable Water Quality standards and guidelines and Best Management Practices.

Mechanical fuels treatment would occur on frozen ground or snow pack which eliminates direct disturbance to soils. Hand work and suite of proposed light-touch treatments to thin and remove dead and down trees may occur at any time, and are anticipated to have no measurable adverse effects to fish. Pile burning would occur in the fall, and therefore, have a chance to generate suspended sediment during rain events. Fish bearing streams adjacent to Units 1 3, 7, and 12 would require 100-foot no-disturbance stream buffers. Intact riparian areas adjacent to streams can serve as a filter for water quality and limit of introduction of contaminants into the stream. In addition, buffers would provide shading, stream temperature moderation, overhanging vegetation as a source of input of vegetative and insect derived foods, and bank stability from intact roots. Other benefits of stream buffers are recruitment of trees into the stream that would add to instream pool formation and overall habitat complexity.

Findings

No threatened or endangered species are known to occur in or immediately adjacent to this project area.

Plants

Alternative 1, No Action

Effects

In this alternative, no fuels reduction activities would take place. Existing conditions would persist and sites would continue to change through natural processes. The project area may grow more prone to fire as fuels continue to build up.

Non-Native Plants

Existing populations of non-native plants would likely continue to persist and spread into surrounding areas. Generally, non-native plants are not present in natural habitats and the spread of non-native plants into undisturbed areas would likely remain at the current slow pace.

Fires can create an ideal seed bed for many non-native plants, which tend to be early successional species. Since no fuel reduction activities would take place, there is a chance that some areas may be more prone to larger fires under this alternative, potentially resulting in ideal sites for spread of non-native species.

Region 10 Sensitive Plants

A rare plant survey of intensity level 5 has been conducted in the project area and a population of *Papaver alboroseum* was found near Unit 6. This species grows in open, well-drained sites and appears to thrive in areas with some ground disturbance. With no action proposed, this population would likely continue to persist until the site grows too shady or a wild fire impacts the population.

Alternative 2, Proposed Action

Effects

Non-Native Plants

This alternative has the potential to introduce and spread non-native plants throughout the project area. In addition to effects associated with the No Action alternative, direct impacts would come from fuels reduction activities. Of particular concern are units with mechanical treatments and chipping. Proposed activities could spread these weed species throughout the project area and increase the likelihood of spread into neighboring areas. Existing weed fragments and seeds can easily be caught on equipment and transported to new areas.

Newly disturbed ground is an ideal bed for many non-native plants to become established, especially if seed sources are nearby. Since there are non-native plant populations in the project area, any area with new ground disturbance would be highly vulnerable to weed introductions. The Chugach Invasive Plant Plan (2005) recommends the following management actions to help prevent the spread of weeds into uninfested areas.

- For all projects involving revegetation, use natural revegetation where seed source and site conditions are favorable, or use native plant species in revegetation/restoration projects when natural revegetation conditions are not favorable (Forest Plan page 3-25). Preference should be given to plant materials from the local environment of the project area to maximize adaptation to that environment and maintain local genetic composition.
- In areas where future ground disturbing activities are scheduled to occur within invasive plant infestations, appropriate invasive plant treatment applications should be conducted prior to project implementation to reduce future spread and establishment. Ideally, ground disturbing activities should be timed to minimize the potential of providing favorable seed beds when invasive plant species have developed mature seeds.
- Prior to entering National Forest land, agency personnel, permittees, and contractors are required to clean the equipment they intend to use. Equipment should be free of dirt and plant materials. Similarly, when working on trails, the cleaning of tools and equipment between work sites along the trail would help prevent transport of invasive plant seed and vegetative reproductive structures further along the trail. Equipment may be inspected by agency personnel prior to use.

Region 10 Sensitive Plants

In compliance with policies and standards set forth in the Forest Service Manual (FSM 2670) a Biological Evaluation for sensitive plants has been completed and contains more details on the analysis and determination of effects.

Direct Effects

Mechanical treatments and burning may destroy some pale poppy plants that are present in unit 6. However, this species is also known to thrive in areas with human disturbance and although proposed activities may destroy existing plants, they may also provide favorable sites for new plants. No other sensitive plants are within the footprint of the project, there would be no direct loss to the other species from proposed activities.

Indirect Effects

Indirect effects would come from non-native plants that compete with sensitive plants for available habitat. General impacts associated with non-native plants have already been discussed above. Potential infestations of non-native plants can have devastating impacts on rare plants and habitats. An example from Glacier National Park has shown that the non-native spotted knapweed (*Centaurea maculosa*) eliminated seven rare and uncommon species within three years (Montana Weed Control Association and Montana State University). Since many of the natural habitats in this area are still generally free of non-native species, threats of that magnitude are not likely to occur in the near future. However, as presence and spread of non-native plants increase as a result of proposed management activities so does the risk of negative impacts to R10 sensitive species and their habitats.

Cumulative Effects

Other activities in the area include the Seward and Sterling Highways, recreational activities, and other human development. Cumulatively this proposal adds approximately another 412 acres of potential vegetation modification and ground disturbance. Across the Kenai Peninsula portion of the Chugach National Forest, there are vast acres of potential habitat (over one million acres). Cumulatively, the potential loss or modification of another 412 acres would not make a measurable effect to sensitive plants when over one million acres of potential habitat still exist on the Kenai.

Determination of Effects

Because potential and occupied habitat occurs in the project area, there is potential that sensitive species and habitat may be impacted by the proposed action. However, mitigation measures should minimize these impacts. In addition there are large areas of undisturbed habitat across the Kenai Peninsula. The proposed alternatives would contribute up to 412 additional acres of potential habitat loss. This loss would not lead to any measurable effects to sensitive plants when over one million acres are present across the Kenai Peninsula. Therefore the final determination of effects is that the proposed activities may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or cause a loss of viability to the population or species.

Water Resources

Alternative 1, No Action

Effects

The No Action Alternative would result in no change from the existing condition. Because no treatments would occur, no direct effects would occur to stream channels, streamflows, water quality, floodplains, or wetlands. Indirect effects to water resources could occur as a result of increased risk of wildfire from not treating fuel loading related to continued spruce bark beetle impacts. If it were to occur, catastrophic wildfire could cause considerable changes to stream channel morphology, flow regimes, erosion and sedimentation, and riparian health in the short term.

Alternative 2, Proposed Action

Effects

The proposed treatments would have little or no direct or indirect effects on stream channel processes, bank stability, or riparian condition. Treatment would not occur within 100 feet of anadromous streams, and Best Management Practices would be followed to protect riparian zones and maintain bank protection, habitat conditions, and recruitment of woody debris (see mitigation measures).

The proposed treatments would have little or no direct or indirect effects on streamflows in the area. Because the Proposed Action would remove primarily dead and dying spruce, this would have little effect on evapotranspiration rates. With the small percentage of the watersheds affected and the fast rate of understory regrowth that would occur, the Proposed Action would not increase rates of surface runoff. The Proposed Action would decrease the risk of wildfire, minimizing potential changes in flow regime that could occur because of increased runoff in burned areas.

The proposed treatments would have little or no direct or indirect effects on water quality in streams or lakes in the area. The use of hand treatment and winter mechanical treatment would decrease the potential for ground disturbance. Sediment from surface erosion would be minimal because of the limited amount of ground disturbance and the fast rate of understory regrowth. The Proposed Action would decrease the risk of wildfire, minimizing the potential for sedimentation that could occur as a result of loss of ground cover in burned areas.

The proposed treatments would have little or no direct or indirect effects on floodplains and wetlands because treatments would not occur within 100 feet of streams or in areas of mapped wetlands (see mitigation measures). The use of hand treatment and winter treatment would minimize the impacts to any small, unmapped wetlands in the area. The Proposed Action meets the intent of Executive Order 11988 for floodplain management and Executive Order 11990 for protection of wetlands.

Heritage

Effects

As a whole, going forward with the Tern Lake Fuel Reduction project, as currently designed, would result in No Historic Properties Affected, given the stipulation that all identified cultural resources are avoided by the Project.

Scenery

Alternative 1, No Action

The No Action Alternative should not affect the scenic resources within the project area.

Alternative 2, Proposed Action

Effects

Scenic Integrity Objective (SIO) acreage within a drainage or project area may be changed up to 20 percent without amending the Revised Forest Plan. Within the project area there is approximately 1,347 acres of High SIO along the Seward and Sterling Highways. Of this acreage, 101 acres have the potential to be modified or changed as a result of the thinning proposed. This change would equal about 7.5% of the National Forest lands within the project area. A fuel reduction treatment using a diameter plus three prescription would slightly modify the foreground setting. There would be little effect on the middleground and background setting. However, not limbing leave trees would maintain the patterns common within this landscape character needed to retain a high SIO characteristic.

The maximum treatment of 15' by 15' bole spacing on trees 5" DBH and smaller along the 200 foot buffer zone along the Seward Highway in units 1, 2, 3, and 12 would alter the natural appearing landscape in the foreground for highway travelers. This spacing will make a more park-like (manicured) appearance. This would be a short term impact until these spacings filled up with other vegetation on the landscape compared to the more irregular appearance of natural views within the area.

The Seward Highway Corridor Partnership Plan (SHCPP) recommends that future development be concentrated in clusters or nodes. The Highway's character would only be retained if it can continue to provide a feeling of wild openness and solitude, if it offers an experience of escape, and if future development either recedes into the landscape and/or buildings and sites are regionally distinctive in architecture, materials and setting. Any future conveyances of public lands would have a 150' deep buffer adjacent to the conveyance areas to buffer and protect the roadside character. However, the private lands within the project area are historic homesteads and do not fall within the land management framework recommended by the Partnership Plan. During these early conveyances there were no setback buffers to protect the roadside character of the Seward Highway. Thinning of the natural buffers adjacent to the private lands in Units 1, 11, and 2 and within the gravel pit buffer would affect screening of haphazard development. Units 1, 2, 3 and 11 are adjacent to private land. These private properties fit best as Corridor Development Areas within the SHCPP. These corridor are the linear areas parallel to the roadway within which low density,

dispersed development is likely to occur. There is no set-back zoning so buffering development adjacent to the private parcels where development could be seen from the road way would likely offer some protection.

Access into Unit 4 for project activities would be across the avalanche slope on the south side of Tern Lake. This access route would be visible from the pull-out at the intersection of the Sterling and Seward Highways.

Unit 6 is adjacent to and within the old Tern Lake Campground. Most of the beetle kill spruce has been taken out of this unit. Limited short term unnatural views due to mechanical use and access may affect some users of the site. But, the overall long-term impacts would be low.

There should be little effects on the visual resources from the proposed action in Units 5 and 8.

Cumulative Impacts

Other project/activities near the Project area include: expansion of the Mile 35 gravel pit, the expansion of the Tern Lake Day Use Area in association with the Daves Creek Restoration Project, and the stream restoration project at Daves Creek. In combination with the proposed actions, these activities may impact the short term scenic resources of the Highway corridors. Although the gravel pit expansion and initial project activities for the Proposed Action and the Daves Creek Restoration Project activities are complete, the overall impacts to the Highway corridors should be minimal. Scenic resources should be enhanced in the long term by improvements to the Day Use Area, Daves Creek, and reduction in potential wildfire along the Highway corridors.

Recreation

Alternative 1, No Action

Effects

The No Action Alternative should not affect the recreation resources within the project area. The existing recreation opportunities would remain the same. If a catastrophic wildfire were to occur due to the increased fuel load, recreation opportunities may decrease because the lack of vegetation may increase the likelihood of decreased wildlife in the area temporarily decreasing hunting and wildlife viewing opportunities. A catastrophic wildfire would eventually lead to fallen trees across access points reducing hiking and other trail access.

Alternative 2, Proposed Action

Effects

The primary effect or concern with this project as they pertain to the recreational resources is maintaining a natural appearing viewshed within the Sterling and Seward Highway corridors, the Tern Lake Wildlife Viewing Area, and the Tern Lake Day Use Area which were analyzed under Scenic Resources. A secondary concern would be unauthorized off road vehicle use in the areas opened up by this project.

Vegetation removal activities within Unit 6 & 7 would have little effect on the recreation resources with the exception of wide space thinning adjacent to the Old Sterling Highway corridor. A thick row of spruce trees line this corridor. These spruce act as a natural fence keeping vehicle travel within this corridor. A maximum thinning of spruce trees less than 5-inch DBH to 15 foot x 15 foot bole (trunk) spacing has the potential to allow OHV (off-highway vehicle) use off of this route into the unit. An additional, but to a lesser, concern would be the potential for dispersed camping to developing outside of the Day Use Area, which is closed to overnight camping.

Activities in Unit 4 have the potential to impacting the view for users of the Tern Lake Day Use Site. Vegetation removal activities would be visible from this site if done during the summer season. Unit 4 lies directly across Tern Lake from the viewing areas. Personnel in safety apparel and equipment would be visible on the lake side of the hill in this unit. Cuttings and slash piles would not be as visible because of the distance from the viewing sites. Access into unit 4 has some potential to develop into a user made trail. Mitigation for this unit would be to perform project work between September 15 and May 15th.

Fuel reduction work within units 5 & 8 would have little effect on the recreational resources of the area. Access into unit 5 from the powerline would need to be coordinated with Chugach Electric.

There would be minimal effect from the project activities within units 1, 2, 3, 11, & 12 on recreation. All access points created during the project would need to be monitored and, if needed, physically closed after the work is completed. Highway screening would be maintained near the Mile 35.5 Swimming Hole.

There would be no direct effects to dispersed campers in the project area. The short term direct effects on recreation users and private landowners within the project area are an increase in noise, the smell of smoke from pile burning, and visual distractions. Long term direct effects would be potential user developed OHV trails initiating from access points and private lands. There may be an increase in winter snowmachine use where the forest is opened up.

Cumulative Impacts

The analysis area used for recreation is the upper Moose Creek and the upper Daves Creek drainages from Mile Post 34 of the Seward Highway to Mile Post 38 of the Sterling Highways.

The cumulative effects analysis for the recreational resource is the project area, including both National Forest System lands and those under other ownership. Outside of the Tern Lake Day Use Area, the Wildlife Viewing Area at the Highway junction and the Mile 35.5 swimming hole there are no recreational developments and few documented activities that take place on National Forest System lands. Recreational activities initiating on the private lands within the project area do flow onto adjacent National Forest System land. The Recreational Opportunity Spectrum (ROS) class would remain as roaded natural (RN) under the proposed action. The recreation resources within the project area based on these actions and other activities may be slightly impacted in the short term but monitoring and law enforcement should mitigate any potential effects.

Compliance with Other Laws and Regulations

Endangered Species Act -Biological evaluations were completed for threatened, endangered, proposed, and sensitive plant and animal species. No threatened and endangered plant or animal species would be affected by any of the action alternatives.

Bald Eagle Protection Act -Management activities within bald eagle habitat would be in accordance to a Memorandum of Understanding between the Forest Service and the U.S. Fish and Wildlife Service. No bald eagle nests are known in the project area.

ANILCA Section 810, Subsistence Evaluation and Finding -There is no documented or reported subsistence use that would be restricted by any of the action alternatives. For this reason, none of the alternatives would result in a significant possibility of a significant restriction of subsistence use of wildlife, fish, or other foods.

National Historic Preservation Act of 1966 -Section 106 of the National Historic Preservation Act requires that all federal undertakings follow the regulations found at 36 CFR §800 to identify and protect cultural resources that are within the project areas and which may be effected by projects. The Chugach National Forest has followed the procedures in the Second Ammended Programmatic Agreement among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer (SHPO) regarding management of the project area. A finding of "no historic properties affected" has been reached by the Forest Service and this report is included in the 2010 Programmatic Agreement Annual Report to the SHPO.

Executive Order 12898 -Environmental Justice -Implementation of this project is not anticipated to cause disproportionate adverse human health or environmental effect to minority or low-income populations because the proposed activities are not expected to cause any affects to human health or result in meaningful adverse environmental consequences.

Clean Air Act -Any pile burning anticipated from the implementation of the Proposed Action would be of short duration and would not be expected to exceed State of Alaska ambient air quality standards (18 AAC 50).

Executive Order 13112 -Invasive Species -Invasive species populations would have little potential to spread in the project area.

Executive Order 11988 and 11990 - The Proposed Action meets the intent of Executive Order 11988 for floodplain management and Executive Order 11990 for protection of wetlands.

Recreational Fisheries (E.O. 12962) - Federal agencies are required, to the extent permitted by law and where practicable, and in cooperation with States and Tribes, to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities. This action is consistent with this order because it would not impact the public's ability to recreationally fish in this area.

Magnuson-Stevens Fishery Conservation and Management Act - This project is not expected to result in any adverse effects to essential fish habitat because it is a low intensity action and proper application of applicable Forestwide standards and guidelines and Best Management Practices. Following these protocols and practices would also ensure that there

are no additional impacts to fish populations and habitat over time and therefore no negative cumulative effects.

Agencies and Persons Consulted

The Forest Service consulted an interdisciplinary team of resource specialists in the development of this environmental analysis. The proposal was first listed in the Schedule of Proposed Actions since the second quarter of 2009, January 1 to March 30, 2009. The proposal was provided to the public and other agencies for comment during scoping for 30 days when it was published in the Anchorage Daily News on November 17, 2009. In addition, as part of the public involvement process, the agency hosted two public meetings on December 17, 2009 and January 28, 2010 at the Moose Pass Community Center.

Literature Cited

Action Plan. 2004. All Lands/All Hands Action Plan. Kenai Peninsula Borough. Alaska.

Albini, F.1976. Estimating Wildfire Behavior and Effects. USDA For. Serv. Gen. Tech. Rep. INT-30.

Anderson, H. E. 1982. Aids to determining fuel models for estimating fire behavior. USDA For. Serv. Gen. Tech. Rep. INT-122.

Berg, E. 2000. Post-fire regeneration on the western Kenai Peninsula, AK: a 48 year record from nine permanent plots. Unpublished manuscript. Kenai National Wildlife Refuge, AK.

Block, R., K.C.J. Van Rees, and D.J. Pennock. 2002. Quantifying harvesting impacts using soil compaction and disturbance regimes at a landscape scale. Soil Sci. Am. J. vol. 66:1669-1676.

Chugach National Forest Revised Land and Resource Management Plan (Forest Plan). 2002. Chugach National Forest – Revised Land and Resource Management Plan. USDA Forest Service, Chugach National Forest, Anchorage, AK

DeBano, L.F., D.G. Neary, and P.F. Ffolliott. 1998. Fire's effects on ecosystems. John Wiley & Sons, Inc., New York, NY.

DeLuca, Thomas H. 2000. Soils and nutrient considerations. In: Smith, Helen Y., ed. 2000. The Bitterroot Ecosystem Management Research Project: what we have learned: symposium proceedings; 1999 May 18-20; Missoula, MT. Proc. RMRS-P-17. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 23-25.

FPS (Fire Program Solutions). 1999 – 2004. On the web at: www.fireps.com. Estacada, OR.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. USDA, FS, Intermountain Res. Sta., Res. Paper INT-RP-477.

Kenai Peninsula Burough. 2006. Moose Pass Community Wildfire Protection Plan. Spruce Bark Beetle Program, Kenai Penninsula. Borough Soldotna, AK.

National Wildfire Coordinating Group 1992. Fire Behavior Field reference Guide. U.S. Department of Interior and U.S. Department of Agriculture. February 1992. PMS 436-4 NFES 2224.

Neary, D.G., C.C. Klopatek, L.F. DeBano and P.F. Ffolliott. 1999. Fire effects on belowground sustainability: a review and synthesis, Forest Ecology and Management 122 (51-71).

NIFC (National Interagency Fire Center). 2001. Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001).

Norton, J.M. 2000. Nitrogen mineralization immobilization turnover. p. C 148-160. In M.E. Sumner (ed.) Handbook of soil science. CRC Press, Boca Raton, FL.

Potkin, M. 1997. Fire history disturbance study of the Kenai Peninsula mountainous portion of the Chugach National Forest. Draft. USDA Forest Service, Chugach National Forest, Anchorage, AK.

Rothermel, R. C. 1972. A mathematical model for predicting fire spread in wildland fuels. USDA For. Serv. Res. Pap. INT-115.

Schmidt, Kirsten M.; Menakis, James P.; Hardy, Colin C.; Hann, Wendall J.; Bunnell, David L. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p.

Schulz, B. 1998. Bluejoint Reedgrass: Basic ecological considerations. Interagency Forest Ecology Study Team, Alaska Dept. Fish and Game, Juneau, AK.

Tiedemann, A.R.; Woodard, P.M. 2002. Multiresource effects of a stand replacement prescribed fire in the *Pinus contorta-Abies lasiocarpa* vegetation zone of central Washington. Gen. Tech. Rep. PNWGTR- 535. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 26 p.

USDA and USDI. 2000. Managing the impact of wildfires on communities and the environment, A report to the president in response to the wildfires of 2000. USDA Forest Service and US Department of Interior, Washington D.C.

USDA and USDI. 2001. 10-year comprehensive strategy: A collaborative approach for reducing wildland fire risks to communities and the environment, U.S. Department of Interior and U.S. Department of Agriculture. August 2001. 21 p.

USDA Forest Service, Alaska Region. 2006. Soil and Water Conservation Handbook (FSH 2509.22). USDA Forest Service, Alaska Region.

USDA Forest Service. 2005. Chugach Invasive Plant Plan. Alaska Region, Chugach National Forest, Anchorage, AK

APPENDIX A:

Biological Evaluation for Threatened, Endangered or Sensitive Species

CHUGACH NATIONAL FOREST - Biological Evaluation

Date: July 2009
Project Name: Tern Lake Hazardous Fuel Reduction Fuel Reduction Project
District: Seward Ranger District
Project Type: Fuel Reduction
Location: Seward District – Moose Pass
Project Actions: Cut, pile, burn dead trees. Thin sub-dominant and small trees.
Vegetation/Habitat Type: Understory re-initiation mixed forest of Lutz spruce, birch, aspen, and hemlock.

I. Prior Biological Evaluation				**• o**	**• es**
Prior Project BE: Wildlife	Date:			X	
II. Species and/or Habitat				**No**	**Yes**
2. Previous Species Observation				X	
3. Federally Listed Species Present				X	
4. Habitat For Federally Listed Species Present				X	
5. Sensitive Species Present				X	
6. Habitat For Sensitive Species Present				X	
III. Analysis of Effects				**No**	**Yes**
1. Significant Habitat Alteration					X
2. Effects Outside Project Area				X	
3. Cumulative Effects on Listed Species or Habitat				X	
4. Cumulative Effects on Sensitive Species or Habitat				X	
IV. Determination of Effects				**No**	**Yes**
1. No Affect Threatened, Endangered, or Proposed Species					X
2 May Affect Threatened, Endangered, or Proposed Species				X	
3. May Affect Individual Sensitive Species				X	
4. May Affect Sensitive Species' Population Viability				X	
V. Consultation Requirements				**No**	**Yes**
1. Formal Consultation Required				X	
2. Additional Informal Consultation Required				X	
Based on the findings above and the size and effect of the proposed project, a detailed biological evaluation and further consultation are not required.					
Prepared and Approved By	Mary Ann Benoit		Date: 7-14-2009		